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CANADIAN ENERGY RESEARCH INSTITUTE

BOARD OF DIRECTORS ANNUAL REPORT:

YEAR ENDED MARCH 31, 1991

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MESSAGE FROM THE CHAIRMAN

I continue to be encouraged by the progress which has been made towards development of the Canadian Energy Research Institute (CERI) as a world class centre for research in energy economics. The Canadian Energy Research Institute is now recognized internationally through the high quality of its research reports on issues in energy economics and policy. The success of the conference and seminar program, interest in the CERI world oil market and world gas trade study programs, visits by OPEC officials and sponsorship involvement by the California Energy Commission, the Gas Research Institute and a growing number of foreign energy corporations reflect this recognition.

Four government organizations have become CERI sponsors and a number of international associate sponsor relationships have emerged since the five-year Institute sponsorship agreement was signed in 1988. The Private Energy Research Association, which provides business sector support to CERI, has seen its membership grow significantly. These developments will contribute to the financial stability required for planning purposes and help to ensure that CERI will have the necessary depth and breadth of expertise in place to address the issues of concern to business and government.

The Institute provides a unique means whereby government and industry representatives come together to discuss and seek cooperative solutions to international, national and regional energy issues and problems. Because Canadian energy market developments will continue to be strongly influenced by events abroad, the Institute will continue to assess the effect of developments outside of Canada. This will increase the Institute's association with foreign governments and corporations and, in turn, increase awareness of CERI as a centre of expertise.

I encourage government agencies and companies not already involved with CERI to explore the benefits of sponsorship directly, as in the case of public sector agencies, or indirectly, through membership in the Private Energy Research Association, in the case of business. This will help to develop further the facility which CERI provides for pooled research and enrich the research process by broadening the Institute's growing contact network. Much remains to be accomplished. But I believe that the Institute is well on the way to meeting the aspirations which its founding sponsors set out in 1975.

Alastair H. Ross, Chairman

PRESIDENT'S MESSAGE

The Institute continued to build a reputation for high quality, independent analysis during the year ended March 31, 1991 with the release of several important studies including two which assessed various emerging energy generation and energy use technologies and a report on the workability of market-based means for encouraging industry to reduce atmospheric emission of greenhouse gases. The research program put in place during the preceding year helped to attract additional sponsor groups. This brought the total number of CERI sponsor organizations to ten from eight. At the same time, the Private Energy Research Association continued to attract new member companies and, as a result, the Association was able to increase the level of its annual sponsorship support to the Institute. In all, the year was one of considerable achievement for CERI and its staff.

Sponsorship agreements entered into during 1990/91 with Environment Canada and with the Northwest Territories Department of Energy, Mines and Petroleum Resources broadened the Institute's financial support base and enabled the Institute to increase the complement of its research staff from ten to eleven persons. Also, linkages forged between CERI staff and staff of new and existing sponsor organizations expanded the Institute's contacts with industry and government, facilitating the undertaking of path-breaking analyses on topics such as the impact of clean coal technologies on atmospheric emissions.

At the end of the year a sponsorship arrangement was being discussed with Industry, Science and Technology Canada. This would assist further development of the CERI network, help to ensure that the economic impacts of emerging technologies are addressed, where appropriate, in CERI studies, and facilitate broadening the study program to include discussion of the impact of emerging technologies on selected industries.

CERI staff have been engaged in a broad range of studies over the past year. The ambitious world gas trade study program was launched. Development of the Alberta oil supply evaluation system continued and, in spite of a number of difficulties, the project was moved close to completion. Completion of a major study comparing the economic and environmental attributes of four alternative transportation fuels (ethanol, methanol, propane and compressed natural gas) focussed attention on CERI as a centre of expertise. Among studies completed were an examination of an emissions permit trading system as a means of controlling atmospheric emissions, a study

of markets for British Columbia natural gas, and an update of world oil market expectations.

Involvement with energy industry companies and other interested parties was increased through CERI research forums at which research topics for submission to the CERI Board were discussed, through the conference/seminar program, and through the project advisory committee process. Greater contact with government, business, and university groups had, and will have, a favourable impact on the research program by, for example, ensuring that study topics are relevant and that the research teams benefit from access to practical expertise and the most recent information available.

During 1990/91 three members of the research staff took up positions in industry. However, well qualified persons, including an economist with fifteen years of energy industry experience, were attracted to fill the vacant positions. Through the years more than forty economists, engineers, and geologists have worked on various research projects at CERI, gaining experience and expertise before taking up positions in government and industry.

Gerry Angevine
President

ABOUT THE INSTITUTE

The volatile and divisive energy issues and energy markets of the 1970s demonstrated a need for independent and non-partisan perspectives on energy matters by both industry and government. The Canadian Energy Research Institute (CERI) was established in 1975 to meet this need. In order to guide the Institute's endeavours, seven objectives were developed and incorporated into its constitution as follows:

(1) A capacity for research and analysis which can be used by industry, various levels of government, and others, for investigation of problems related to energy industries;

(2) Alternative approaches to the solution of these problems;

(3) Increased opportunities in interdisciplinary studies and research for staff and students of the University of Calgary and of other universities, and for industry and government employees;

(4) Increased supply of persons with competence and experience in analyzing problems of resource development;

(5) Increased opportunity to advance basic knowledge in subject areas of vital importance to Canada;

(6) In due course, an independent source of reliable data; and

(7) An instrument for liaison between the energy industries, government and universities.

Given the complexities and long-term nature of energy industry development, accurate and reliable information is crucial for proper decision-making and policy-setting. An economic research capability which is independent, and recognized and respected in all matters relating to energy is of benefit to government, the energy industry, industries which interact with it, and energy consumers. CERI brings together experts and senior officers and officials from energy industry corporations, universities, and governments to study energy issues and opportunities including those arising from interaction of energy development, production, transportation, and consumption with the environment and economic analysis pertaining to emerging energy technologies, their comparative advantages and their likely impacts.

During more than 15 years of operation, the Institute has established a reputation for successful achievement of these objectives. CERI's continuing success and reputation are dependent on its research remaining objective and non-partisan as well as relevant to the times. A number of factors serve to assist the Institute to meet its goals. The Institute's funding structure is designed to encourage support from a broad cross-section of private sector energy interests in order to minimize dependence upon any single source of funding from within the business community. Public sector support from across Canada contributes to the assessment of energy issues from both national and regional perspectives.

In the main, the Institute's independent status is safeguarded by its Board of Directors. The Board members, who are appointed by the sponsoring organizations, develop the research program. The process requires the industry and government representatives to focus on the most pressing issues and to allocate the sponsorship contributions to those projects of greatest interest and concern. Once directors approve a project and the related budget, they are kept informed of its progress. However, as a rule, Board members do not see study reports until after they have been published. This allows the Institute staff to be objective in drawing conclusions and making recommendations. The quality of the work is assured by establishing strong advisory panels for projects.

The parties which sponsor the Institute are: Energy, Mines and Resources Canada, the Alberta Department of Energy; the Private Energy Research Association (composed of corporate members); the University of Calgary; the Ontario Ministry of Energy; the Saskatchewan Department of Energy and Mines; the British Columbia Ministry of Energy, Mines and Petroleum Resources; the Energy Resources Conservation Board (Alberta); Environment Canada; and the Northwest Territories Department of Energy, Mines and Petroleum Resources. A number of foreign governments and corporations also support the Institute's research program.

The Institute is housed in the Energy Resources Research Building which is located in the University Research Park adjacent to the University of Calgary. Other major occupants of the building are the Petroleum Recovery Institute and the Computer Modelling Group. The building contains the I.N. McKinnon Memorial Library's collection of energy-related books, journals and documents. Interaction among the various groups is extremely helpful for the research process.

Liaison between government and industry, provision of reliable and accurate energy sector information, publication of the results of analysis and

policy recommendations to government, the energy industry, and energy consumers, and the training of energy economists are the major services which the Canadian Energy Research Institute provides to its sponsors and to the public at large.

The Institute is dedicated to the provision of excellence in economic research and in the analysis of energy and "energy and the environment" issues. It serves government, the energy industry and energy consumers by undertaking independent research and publishing the results. The Institute's publications are placed in the public domain to ensure access by all interested parties.

BOARD OF DIRECTORS

The Institute is managed by a Board of Directors and a President, Dr. G. E. Angevine. The President is assisted by Mr. A. E. Reinsch, Vice President. They are supported by a staff of nine economists and analysts, a conference director and a small secretariat.

The Board of Directors consists of representatives of the CERI sponsor organizations and embodies a unique range of experience and expertise. The Board is an essential part of the Institute, meeting quarterly to set overall fiscal and operating policy, and to approve and initiate research projects and budgets. At the close of the fiscal year, in April, 1991, members of the Board, in addition to the President, were as follows:

The University of Calgary

Dr. M. B. Brinkerhoff, Associate Vice President (Research).

Dr. F. A. Campbell, formerly with The University of Calgary as Vice President, Priorities and Planning, and now a consultant. Vice-Chairman of the Board.

Mr. H. G. Schaefer, Chairman, TransAlta Utilities Corporation.

Alberta Department of Energy

Mrs. Pat Black, Alberta M.L.A. for Calgary Foothills.

Mr. W. D. Dickie, former Alberta Minister of Mines and Minerals.

Dr. R. Hyndman, Assistant Deputy Minister. Dr. Hyndman replaced Mr. N. MacMurchy in the fall of 1990.

Energy, Mines and Resources Canada

Mr. A. Delisle, Vice-president, Corporate Planning, Hydro-Quebec, Montreal. ***Mr. J. P. Leveille*** is the alternate representative.

Mr. R. Edwards, Director, Energy and Resource Policy Division, Canadian Department of Finance. ***Dr. K. Sahay*** is the alternate representative for the Department.

Mr. S. O'Dell, Acting Director General, Economic and Financial Analysis Branch, Energy, Mines and Resources Canada. ***Mr. W. Jarvis*** is the alternate representative for the Department. .Mr. O'Dell replaced Mr. D. Oulton, Assistant Deputy Minister, during the year.

Ontario Ministry of Energy

Mr. D. Taylor, Manager, Economics and Forecasts. ***Mr. G. Davies and Ms. J. Lam*** are the alternate representatives.

Saskatchewan Department of Energy and Mines

Mr. M. Benson, Assistant Deputy Minister, Resources Policy and Economic Division. ***Mr. D. McFadyen*** is the alternate representative. Mr. Benson replaced Ms. P. Youzwa, Deputy Minister, during the year.

Private Energy Research Association

Dr. G. Capobianco, President and C.E.O., The Coal Association of Canada.

Mr. C. K. Orr, Group Vice President, TransCanada PipeLines Limited.

Mr. T. H. Renner, President and C.E.O., Saskatchewan Oil and Gas Corporation.

Mr. A. H. Ross, Chairman, Pacific Enterprises Oil Co. (Canada). Chairman of the Board.

Mr. D. G. Stoneman, Executive Vice President, Resources, Shell Canada Limited.

Energy Resources Conservation Board

Dr. J. P. Prince, Co-chairman.

British Columbia Ministry of Energy, Mines and Petroleum Resources

Mr. P. Ostergaard, Assistant Deputy Minister, Energy Resources Division. Mr. Ostergaard replaced Mr. J. Allan, Deputy Minister, on the CERI Board during the year. ***Mr. G. Douglas*** is the alternate representative for the Ministry.

Environment Canada

Mr. B. Emmett, Director-General Policy. ***Ms. P. Godzaman*** is the alternate representative.

Northwest Territories' Department of Energy, Mines and Petroleum Resources

Mr. P. Alvarez, Deputy Minister. The alternates for Mr. Alvarez are ***Mr. G. Nicholls*** and ***Mr. D. Burch***.

RESEARCH STAFF

Members of the CERI research staff as of June 1991, including their areas of expertise, were:

Angevine, Gerry	Natural gas market analysis and forecasting; world oil market developments.
Baker, Barbara	Electricity economics; demand-side management; resource economics and policy.
Considine, Jennifer	World crude oil market economics and modelling; natural gas economics.
Kolody, Anne	Natural gas demand and supply analysis.
Gibson, Michael	Computer program analysis and computer services.
Heath, Michelle	Alternative transportation fuels and policy; enhanced oil recovery; upstream oil economics.
Linder, Peter	Energy economics and policy, especially natural gas.
MacDougall, Michael	Natural gas economics; energy modelling.
MacRae, Morgan	Electricity and coal economics and policy; energy technologies and the environment.
McLachlan, Michele	Analysis of oil and gas finding and replacement costs; economics of advanced oil recovery technologies; energy efficiency and utilization.
Reinsch, Anthony	Electricity economics; world oil market; forecasting and analysis related to petroleum markets; energy policy options; energy utilization efficiency.
Sanford, Nancy	Conference program and publication coordination.

FUNDING
April 1990 to March 1991

Private Energy Research Association	$350,000
Energy, Mines and Resources Canada	175,000
Alberta Department of Energy	125,000
Ontario Ministry of Energy	75,000
Saskatchewan Department of Energy and Mines	25,000
British Columbia Ministry of Energy, Mines and Petroleum Resources	25,000
Energy Resources Conservation Board (Alberta)	50,000
Environment Canada	50,000
Northwest Territories' Department of Energy, Mines and Petroleum Resources	12,500
	$887,500

The University of Calgary serves as trustee and accountant for CERI and provides access to its computer, library and other facilities. A portion of the Energy Resources Conservation Board's commitment is met by the provision of specialized data tapes, other information and professional time.

Environment Canada and the Department of Energy, Mines and Petroleum Resources of the Northwest Territories each initiated sponsorship relationships with CERI in 1990/91. The Northwest Territories' annual commitment is for $25,000 payable in equal semi-annual amounts.

Additional revenue is provided by conferences, seminars and publication sales. Since 1988, revenue has also been provided by foreign government agencies, corporations, and other organizations through international associate sponsorship arrangements.

For the five-year sponsorship period commencing April 1, 1988 the Private Energy Research Association agreed to provide at least $200,000 to CERI annually. In both 1988/1989 and 1989/90 the Association was able to

contribute substantially more than $200,000 because of increases in its membership. In March, 1991 the Association increased its annual commitment to $350,000 for the three years remaining in the sponsors' agreement.

REPORT ON INSTITUTE OPERATIONS

The objective of the Institute's research program is to improve understanding of energy market issues and to provide analyses which will assist government and business in meeting the challenges they face in formulating energy policy and planning for the future.

CERI has developed a network of professionals who advise on particular research projects and of organizations and institutes wishing to collaborate in research efforts. This network comprises noted authorities in Canada and around the world and greatly enriches the Institute's ability to undertake state-of-the-art, objective research. In combination with CERI's core activities and services--research, conferences, staff presentations, and special events--it places the Institute in a unique position to assist government, industry and consumers.

Research Program

The breadth of energy expertise housed within the Institute is reflected in the variety of studies and research reports released since early 1988. Completed research includes studies of Canadian and world crude oil markets, industrial energy demand, electric power planning, continental natural gas market developments, coal/bitumen co-processing, alternative fuels, and oil and natural gas finding and replacement costs. At the time of writing ten projects were at various stages of completion.

The structure and scope of the CERI research program are determined by the Institute's Board of Directors at its quarterly meetings. CERI officers and staff survey government and industry sponsors of the Institute and work closely with the members of CERI Research Forums established for each energy commodity/topic area to develop research ideas and concepts. An advisory committee is established for every new project to ensure the quality of the research output. The administrative stages of the research process include: approval of research proposals and related budgets by the Board of Directors; management and direction of research by senior staff; review of draft reports by Advisory Committee members; finalization of study conclusions and recommendations by senior staff; and publication of research findings for dissemination to the Directors, sponsors, and interested parties.

Increasing interest in the efficiency of energy utilization, in the impacts of energy commodity production, transportation and consumption on

the environment, and in the effect of changes in environmental policy on the energy sector, is evidenced by the following completed projects: a study of energy efficiency in the pulp and paper industry; a study of Canadian prospects for industrial cogeneration; an assessment of the potential for energy efficiency improvements in industrial sector natural gas consumption and of the effects of technological changes on natural gas consumption (in a CERI study of industrial gas demand); a study assessing the market potential for ethanol and methanol as alternative transportation fuels; a comprehensive review of environmental issues and options which impinge upon electric power planning (in a study of critical issues); a study examining emissions permit trading as a policy tool to reduce the atmospheric concentration of greenhouse gases; a study examining the technical, commercial, economic and environmental status of propane, methanol, ethanol and compressed natural gas as alternative transportation fuels; and a study on the potential contribution of clean coal technologies in addressing the tightening environmental restrictions on electric power generation in Canada, released in April 1991.

The Board of Directors of the Institute is committed to continued examination of Canadian energy issues, as evidenced in the description of projects underway provided in the following section. The current research program also reflects CERI's role in examining and advising on international energy market developments. The series of studies on world oil market developments will continue with an August 1991 release examining the aftermath of the Gulf crisis. This complements the monthly World Oil Market Analysis reports. The Institute will release a study of the long-term development prospects for the global natural gas market in late 1991 or early 1992. In addition, the Institute is undertaking a detailed comparison of international energy utilization in order to place Canadian energy usage as accurately as possible in an international context and to provide input to discussions of Canada's position in a possible world convention on global climate change issues.

Studies and Research Reports Published in 1990/91

(1) **Replacement Costs for Oil and Gas in Western Canada: Methodologies and Application. Research Report 90-1.**

Author: **Michele McLachlan**
Released: **April 1990**

Replacement Costs for Oil and Gas in Western Canada: 1970-1989. Research Report 91-1.

Author: **Michele McLachlan**
Released: **February 1991**

These studies replace the CERI oil and gas finding cost series initiated in 1985.

Research Report 90-1 develops and describes two methodologies for deriving replacement costs for crude oil and natural gas in Western Canada. The data and methodologies used in the analysis are provided in detail, together with short-term and long-term replacement cost estimates for Alberta and Saskatchewan for the 1970-1988 period. A discussion of data limitations and appropriate application of the results are included as a guide to the user.

The second report provides an update to the data underlying the analysis, and an extension of the results to 1989, including revisions to prior year estimates.

(2) **Markets for British Columbia Natural Gas. Study No. 35.**

Authors: **David Maerz and Leonard Coad**
Released: **November 1990**

As the continental natural gas market becomes better defined and developed, interest is shifting from British Columbia's traditional gas markets--the domestic B.C. market and the Pacific Northwest--to other possible markets for B.C.'s natural gas resources. This study examines the conditions under which B.C. gas producers could access the California and the eastern continental markets, or penetrate further into B.C.'s traditional export markets. Employing the NARG/GEMS software system developed by Decision Focus Inc. which was used for CERI

Studies 26 and 32, the analysis focuses on the potential role of British Columbia gas within the continental gas market. The results and recommendations arising from the study will assist both government and industry in designing appropriate development policies and marketing strategies for British Columbia's growing natural gas production capability.

(3) Emissions Permit Trading: A Policy Tool to Reduce the Atmospheric Concentration of Greenhouse Gases. Study No. 36.

Author: **Merete Heggelund**
Released: **January 1991**

This study reviews the theory underlying the use of tradeable permits to control emissions of undesirable industrial plant emissions associated with the greenhouse effect and global warming. Use of permit systems to control certain greenhouse gases in other countries is examined. The main focus of the study is on the feasibility of applying tradeable permits to control emissions of CO_2, NO_x, SO_2 and VOCs in Canada, the associated problems and the likely effects on the various stakeholders. To provide an appropriate context for analysis, the study also examines the pros and cons of more conventional fiscal and command/control policy options.

(4) Alternative Transportation Fuels: Natural Gas, Propane, Methanol and Ethanol Compared with Gasoline and Diesel. Study No. 37.

Author: **Michelle Heath**
Released: **February 1991**

This study is an extension of CERI Study No. 29, *Towards a Commercial Future: Ethanol and Methanol as Alternative Transportation Fuels.* The economic, financial, technical and environmental assessments contained in Study No. 29 have been updated and extended to encompass compressed natural gas and propane. The study also provides insights from experience with the various fuels in other countries. The study concludes with a discussion of institutional and economic hurdles and barriers to be overcome if any or all of these alternative fuels are to gain a foothold in the Canadian transportation fuel market.

This project benefitted from a project-specific grant from Energy, Mines and Resources Canada.

(5) New Coal Technology and Electric Power Development. Study No. 38.

Author: Morgan MacRae
Released: April 1991

The potential environmental impact of continued growth in hydrocarbon combustion has reached the top of Canada's energy agenda. The combustion of coal and its effect on the environment have sponsored considerable work on the development of new clean coal technologies. This study examines the role of these new technologies in reducing the environmental impacts associated with coal combustion and the attendant process economics underlying the adoption of these technologies.

The study focuses on Canada's electric power industry, as electric power generation constitutes some 80 percent of total Canadian coal consumption. Following identification and assessment of candidate technologies (e.g., flue gas desulphurization, integrated coal gasification combined cycle, etc.), a number of scenarios were constructed to examine the impact on project cost, timing, and atmospheric emissions, of adopting these technologies.

(6) World Oil Market Analysis (WOMA).

A quarterly publication on events and issues in the world oil market with regular, monthly updates.

Principal Author: Jennifer Considine
Editorial Board: Dr. G.E. Angevine, A.E. Reinsch, N. Sanford.

Feature articles contained in the quarterly issues of WOMA over the 1990-91 period include an assessment of North American upstream investment intentions; an update on gas pipeline projects in the California market region; an analysis of the OPEC basket price and its relation to WTI and Brent crudes; an examination of the financial status of the OPEC member nations; an analysis of Canadian oil industry mergers and acquisitions activity; an outlook for the USSR petroleum

industry; and WOMA Forums on OPEC in the 1990s and International Oil and Gas Market Developments.

These articles were in addition to the regular assessment of the current market situation and short-term outlook, and the annual long-term outlook for the world oil market.

WOMA is provided on a complimentary basis to CERI sponsors and to members of the Private Energy Research Association. It is available to non-sponsors on an annual subscription basis for $345.00.

Research Projects Underway or Approved for Commencement at the Beginning of Fiscal Year 1991/1992

(1) **After the Crisis: World Oil Market Projections, 1991-2006. Study No. 39.**

Author: **Anthony E. Reinsch and Jennifer Considine**
Release: **August 1991**

This study extends the work on world oil market developments embodied in CERI Study No. 28, *Stability Within Uncertainty: Evolution of the World Oil Market*; Study No. 34, *World Oil Market Projections: 1990-2005*; and various issues of *World Oil Market Analysis*.

In the latest release, the impact of the Gulf crisis on market fundamentals is examined and an assessment provided of oil price projections under the new market conditions. Sensitivity analyses include, among others, an examination of the impact of Soviet production prospects on oil market developments.

Subscribers to the CERI World Oil Market Model (WOMM), available exclusively to CERI sponsors, will receive Version 3.5 of the model upon release of the study.

(2) Energy Use in Canada: An International Comparison.

Author: Michele McLachlan
Release: October 1991

The objective of this research is to undertake a comprehensive re-examination, re-estimation and re-assessment of the energy/output ratios being used for international comparisons of energy utilization. The development of measures of energy utilization in Canada will be based on a thorough analysis of the Canadian situation.

This research program is being supported through the provision of incremental research staff by TransAlta Utilities.

(3) Coal in Canada: The Role in Energy, Economy and Environment

Author: Morgan MacRae
Release: October 1991

Tightening environmental controls in the electric power sector in Canada and severe competition in export markets are placing considerable strain on the Canadian coal industry. In this study, CERI is examining the role of the coal industry in Canada's economy, its importance to the future of energy development, and the opportunities and constraints facing the industry in the 1990s.

(4) Demand-Side Management Programs: Application in Canada.

Authors: Barbara Baker and Morgan MacRae
Release: November 1991

Recent actions by Canadian utilities on non-utility generation, electricity trade and demand-side management (DSM), together with government initiatives to reduce atmospheric emissions from electric power production, suggest that broader consideration of demand-side initiatives for Canadian electric power planning would be both timely and important. The purpose of this study is three-fold. First, to examine the array of DSM programs in place in the U.S., isolating those characteristics which have contributed to the success of certain programs, those factors which inhibited, impeded or prevented successful implementation, and program enhancements or amendments which were

required following initial implementation. Second, the study will provide a discussion of DSM initiatives in Canada, focussing on particular types/categories of programs being pursued (or proposed) and the incentive/impediments to DSM development. Third, the study will examine the issue of DSM program transfer from U.S. jurisdictions to Canada, focussing on the regulatory, market and institutional factors which favour/inhibit the successful implementation of candidate DSM programs in the Canadian electricity sector. Where possible, region-specific analysis will be undertaken, thereby enhancing the value of the research to utilities and regulatory authorities across Canada.

(5) Alberta's Conventional Crude Oil Supply: How Much? How Long?

Author: Michelle Heath
Release: November 1991

This study will analyze the short- and long-term supply potential from the Province's currently productive oil formations as well as the remaining potential from undiscovered pools in those geological formations in which oil has already been discovered. To accomplish this task a complex modelling system has been developed which is capable of providing the likely supply response to changes in crude oil prices, royalties, incentive programs, and other fiscal levers.

Incremental funding and/or research support required to augment the Institute's budget allocation to the study were obtained from the Institute for Sedimentary and Petroleum Geology, the Energy Resources Conservation Board, the Independent Petroleum Association of Canada, the National Energy Board, the Canadian Petroleum Association, Energy Mines and Resources Canada, the National Energy Board and the Canadian Petroleum Association and the Alberta Department of Energy. The Alberta Department of Energy provided the services of a staff person to work on the project on a part-time basis.

(6) Issues in the Global Natural Gas Market

Authors: Peter Linder, Anne Kolody and Mike MacDougall
Release: Late 1991 or Early 1992

This study will analyze the prospects for long-term world natural gas trade based upon the outlook for crude oil prices, gas demand by country, LNG costs (liquefaction, transportation, and regasification), pipeline and

distribution costs, proved and potential gas reserves by country, and the associated exploration, development, and production costs on an incremental reserves basis (i.e., the development of supply cost curves).

The global natural gas study has required the development of a comprehensive, network-oriented, supply-demand model of world gas markets and prices. The results of the study will benefit oil and gas producers, pipeliners and government agencies interested in and affected by future flows and prices of natural gas in North America and overseas and in the potential impact of imports of LNG and of Mexican gas on North American energy markets.

By July 1991 all of the required data input had been gathered and the base case model results were in place. During the summer and fall of 1991, sensitivity cases were to be run and a detailed report written. It is anticipated that CERI sponsors will receive the final report in late 1991 or early in 1992.

(7) Integrated Energy Systems: District Heating Applications in Canada

Author: **Morgan MacRae**
Release: **Spring 1992**

In this study, the Institute will examine the planning and policy implications of integrated energy system planning. The potential for application of this innovative approach to energy development will be examined through a micro-level analysis of district heating/cooling projects in Canada. In addition to an assessment of the energy efficiency potential of such projects, the study will attempt to highlight the multi-stakeholder cooperation required to undertake such projects and the regulatory impediments to their successful implementation.

This research is benefitting from financial and professional support by the Energy Research Laboratories of CANMET, a branch of Energy, Mines and Resources Canada.

(8) Enhanced Oil Recovery and Advanced Recovery Technologies: Potential for Application in Saskatchewan

Author: Michele McLachlan
Release: Summer 1992

The intent of this study is to determine the economic, commercial and technical potential for increasing the recovery of crude oil from Saskatchewan reservoirs through the application of enhanced oil recovery techniques (EOR) and horizontal drilling technologies.

Development of the required data base is being undertaken in collaboration with the Saskatchewan Department of Energy and Mines. The development of screening criteria for the recovery processes and of reservoir engineering equations for the assessment of incremental production gains from the application of EOR techniques will be carried out by the Petroleum Recovery Institute. The project is being assisted through project-specific grants from oil companies active in Saskatchewan and by the Saskatchewan Department of Energy and Mines.

(9) Canadian Energy Database

This project is to incorporate and update the historical database transferred to CERI from the Institute for Policy Analysis (IPA) in Toronto. This will be undertaken as, and when, resources become available.

(10) Continental Natural Gas Handbook

Authors: Peter Linder and Michael MacDougall
Release: TBA

The Continental Natural Gas Handbook is intended to be a reference document for new employees in the gas industry and seasoned analysts alike. Building on the historical and regulatory information provided in CERI Study No. 26, *Towards a Continental Natural Gas Market: Historical Perspectives and Long-Term Outlook*, the current study will provide detail on natural gas resources, demand, transportation, trade, pricing and regulation. It is expected that this study will receive wide distribution in industry and government and have significant potential

for application in college/university natural resource and regulatory economics courses.

Research Advisory Committees

The relevance of the research program to critical issues of the day and the high quality of the reports and studies reflect the hours of assistance provided by industry and government experts who serve on project Advisory Committees. The Advisory Committee process helps to ensure that CERI research utilizes the best available technology, embodies the most appropriate and practical methodologies, and is reported accurately and clearly. The interest and commitment of the volunteer advisors is critical to the maintenance of the Institute's high standard of excellence in research. It is greatly appreciated.

The following persons served on project Advisory Committees during the period April 1, 1990 through March 31, 1991:

Mr. Main Adelaar, Marbek Resource Consultant
Mr. John Anthony, CanWest Gas Supply Inc.
Ms. Ellen Battle, Battle Consulting
Mr. Fred Belaire, Atomic Energy of Canada Limited
Dr. John Boatwright, Exxon Company, U.S.A.
Dr. Richard Browning, Phillips Petroleum Company
Mr. Doug Bruchet, Canadian Petroleum Association
Mr. Bill Burden, Amoco Corporation
Mr. Rob Chapman, Shell Canada Ltd.
Mr. Barry Conn, Shell Canada Limited
Dr. Helene Connor-Lajambe, Centre d'Analyse des Politiques Energetiques
Mr. Allen Coombs, Energy, Mines and Resources Canada
Mr. Jim Coyne, Fina Oil and Chemical Company
Mr. Calvin Daniels, Fina Oil and Chemical Company
Mr. Rick Daniels, Esso Resources Canada Limited
Mr. Victor De Buen, B.C. Hydro
Mr. Steve Del Regno, Texaco Inc.
Mr. Gordon Dittmer, Petro-Canada Inc.
Mr. David Dorenfeld, Exxon Corporation
Mr. W.H. Dorsett, Chevron Corporation

Mr. Gordon Douglas, British Columbia Ministry of Energy, Mines and Petroleum Resources
Mr. Duke du Plessis, Alberta Research Council
Ms. Dawn Farrell, TransAlta Utilities Corporation
Mr. Robert Feick, Independent Petroleum Association of Canada
Mr. Pat Finlay, Environment Canada
Mr. Gilles Fournier, Esso Resources Canada Limited
Mr. Cliff Gemeroy, National Energy Board
Ms. Penny Godzaman, Environment Canada
Dr. Roger Goodman, Shell Canada Limited
Mr. Wayne Harper, Energy, Mines and Resources Canada
Mr. Michael Horgan, Environment Canada
Mr. James Hughes, Imperial Oil Ltd.
Mr. Terry Hurst, Energy Resources Conservation Board (Alberta)
Dr. Rick Hyndman, Alberta Department of Energy
Mr. Phil Jago, Energy, Mines and Resources Canada
Ms. Katie Johnson, City of Calgary Electric System
Mr. Tom Kierens, C.D. Howe Institute
Mr. Juergen Kleta, Alberta Office of Coal Research and Technology
Dr. David Kline, California Energy Commission
Mr. Marcel Kramer, Petro-Canada Inc.
Mr. George Lee, CANMET, Energy, Mines and Resources Canada
Dr. Henry Lee, Energy & Environmental Policy Center, Harvard University
Mr. P. J. Lee, Institute of Sedimentary and Petroleum Geology
Mr. Jim Leslie, TransAlta Utilities Corporation
Mr. Wayne Lunt, TransCanada PipeLines Limited
Mr. Court Mackid, Canadian Petroleum Association
Mr. Norm MacMurchy, Alberta Department of Energy
Mr. Harry Maekelburger, Canadian Western Natural Gas
Mr. George Matheson, Marbek Resource Consultants
Mr. Malcolm McDonald, TransAlta Utilities Corporation
Mr. Michael McDonald, Exxon Company, USA
Mr. Dan McFadyen, Saskatchewan Energy and Mines
Mr. Richard McKenzie, Energy, Mines and Resources Canada
Mr. Bob Modray, Gulf Canada Resources Ltd.
Mr. Rob Motal, Chevron Corporation

Mr. Howard Mueller, Electric Power Research Institute
Mr. Al Nawata, Alberta & Southern Gas Co. Ltd.
Mr. Kerry Parsons, Shell Canada Ltd.
Mr. Jeremy Platt, Electric Power Research Institute
Ms. Deborah Plattsmier, Texaco Inc.
Mr. Jim Popowich, Fording Coal Ltd.
Dr. Phil Prince, Energy Resources Conservation Board (Alberta)
Dr. Richard Proctor, Institute of Sedimentary and Petroleum Geology
Mr. Ross Purvis, Energy Resources Conservation Board (Alberta)
Mr. Don Rawlyk, British Columbia Petroleum Corporation
Mr. Phillip Read, CANMET, Energy, Mines and Resources Canada
Mr. Jeff Ross, Environment Canada
Ms. Judith Ryan, Ontario Hydro
Mr. John Sadowski, Enron Gas Liquids, Inc.
Mr. Manoj Sanghvi, Amoco Corporation
Mr. John Schissel, Canadian Hunter Exploration Ltd.
Mr. Philip Schubert, Canadian International Development Agency
Mr. Charles Slagorsky, Shell Canada Limited
Mr. Wayne Soper, Westcoast Energy Inc.
Mr. Glen Sweetnam, Fina Oil and Chemical Company
Mr. Mohammed Taher, Alberta Department of Energy
Mr. Duncan Taylor, Ontario Ministry of Energy
Mr. Frank Trimnel, Ontario Hydro
Mr. Bill Wall, National Energy Board
Mr. John Walsh, Ottawa, Ontario
Dr. Elizabeth Wilman, University of Calgary
Dr. Malcolm Wilson, Saskatchewan Department of Energy and Mines
Ms. Gil Wogin, Department of Finance, Canada
Mr. Sam Wong, Alberta Research Council

Research Forums

Fiscal year 1990/91 saw the continuation of CERI Research Forums. These are closed-door meetings of volunteer industry and government leaders, at least one CERI director, and members of the Institute's research staff which are held to help to identify potential topics for Institute research. The Research

Forum concept is intended to enhance the timeliness and relevance of Institute research in order to better meet the needs of its sponsors.

Research Forums were convened in the areas of energy and environment, crude oil, and natural gas. Forum members are identified below.

Energy-Environment Research Forum

Mr. Ed Barry, Vice President, Research, TransAlta Utilities Corp.
Dr. Fin Campbell
Dr. Giacomo Capobianco, President and C.E.O., The Coal Association of Canada
Mr. Ray Coutts, Sr. Project Manager, City of Edmonton
Mr. Brian Emmett, Director General, Policy, Environment Canada
Mr. Tony Harras, Vice President, Planning, Sask Power
Dr. Paul Hough, Program Officer, Royal Society of Canada
Mr. Norm MacMurchy, Assistant Deputy Minister, Alberta Department of Energy
Dr. Phil Prince, Vice Chairman, Energy Resources Conservation Board
Dr. Harby Sandhu, Senior Manager, Alberta Environment
Mr. Paul Shervill, Manager, Environmental Affairs, Union Gas Ltd.
Mr. Duncan Taylor, Manager, Economics, Ontario Ministry of Energy

Crude Oil Research Forum

Mr. Roger Dunn, Senior Vice President, AEC Oil and Gas Company
Ms. Gillian Hobbs, Director, Strategic Planning, Petro-Canada Inc.
Dr. Rick Hyndman, Assistant Deputy Minister, Alberta Department of Energy
Mr. George Kirkwood, Vice President, Interhome Energy Inc.
Mr. Tom Lester, General Manager, Northridge Petroleum Marketing Inc.
Mr. Dale Lucas, Alberta Petroleum Marketing Commission
Mr. David Martin, President and C.E.O., Co-Enerco
Mr. J. Sherrold Moore, Senior Vice President, Amoco Canada Petroleum Company Ltd.
Mr. Maurice Ruel, Director General, Energy, Mines and Resources Canada
Mr. Art Price, President, Husky Oil Operations Ltd.

Mr. Ted Renner, President and C.E.O., Saskatchewan Oil and Gas Corporation
Mr. Charles E. Schultz, President and C.E.O., Gulf Canada Resources Ltd.
Mr. Doug Stoneman, Executive Vice President, Resources, Shell Canada Limited

Natural Gas Research Forum

Mr. John Anthony, President, CanWest Gas Supply Inc.
Mr. John Beddome, President, Polar Gas Mackenzie Delta Pipeline
Mr. Doug Burch, Resource Economist, Government of the Northwest Territories
Mr. Scotty Cameron, President, Pan-Alberta Gas Ltd.
Mr. Dennis Cornelson, Vice President, Marketing, AEC Oil & Gas Ltd.
Mr. Earle Forgues, Vice President, Gas Marketing, Amoco Canada Petroleum Company Ltd.
Mr. Joe Horler, Vice President, Oil and Gas, BP Exploration Canada Ltd.
Dr. Richard Hyndman, Assistant Deputy Minister, Alberta Department of Energy
Mr. Fred Klein, Director, Natural Gas Business Centre, Shell Canada Limited
Ms. Karen Koncohrada, Acting Director, British Columbia Ministry of Energy, Mines and Petroleum Resources
Mr. Ken Orr, Group Vice President, TransCanada PipeLines Limited
Dr. Phil Prince, Vice Chairman, Energy Resources Conservation Board
Mr. Clayton Riddell, President, Paramount Resources Limited
Mr. Charles Safrance, Senior Vice President & Chief Operating Officer, Consumers Gas Co. Ltd.
Mr. Merv Simon, President, WesCana Energy Marketing Inc.
Mr. Bruce Simpson, Senior Vice President, NOVA Corporation of Alberta
Mr. David Tuer, Vice President, Marketing, PanCanadian Petroleum Ltd.
Mr. Michael Manning, Senior Vice President, Marketing, North Canadian Oils Ltd.

The Institute extends its appreciation to these individuals for their commitment to the CERI research agenda and to the investigation and analysis of energy issues critical to the future of Canada's energy sector.

CONFERENCES AND STAFF PRESENTATIONS

Major Conferences

The Institute sponsored two major conferences during the 1990/91 fiscal year--the ninth international oil and natural gas markets conference and a conference on critical issues in electricity generation planning.

Energy and Electricity: Electric Power Planning in the 1990s, a conference to examine the critical and strategic issues in electric power planning in Canada and the United States, and to draw out the implications for the various players involved, was held in Montreal, June 3-5, 1990. The program consisted of five panel sessions specifically designed to bring together competing views on current issues in the electric power industry: capacity requirements, the regulatory environment, interprovincial and international trade, meeting the capacity additions gap, and the long-term future of the industry.

Organized in collaboration with the Canadian Electrical Association, Energy, Mines and Resources Canada, and Hydro-Quebec, this cross-border event attracted close to 170 delegates, including 28 speakers from both Canada and the United States.

The ninth annual **CERI International Oil and Gas Markets Conference** took place at the Convention Centre in Calgary, on September 23-25, 1990. It was co-sponsored by The Calgary Chamber of Commerce. The Conference drew almost 375 delegates from across North America and around the world and invited 30 distinguished speakers. The program focused on the world oil market, the environmental challenges facing the oil and gas industry, Soviet oil and gas, global natural gas supply and the North American natural gas market.

Staff Presentations

1991

February "View from the North". Presented by Michelle Heath to the Conference on New Fuels for Cleaner Air. Phoenix, Arizona, February 26-27, 1991.

January "New Coal Technologies, Environmental Initiatives and Electric Power Development". Presentation by Morgan MacRae to the Canadian Capabilities in the Environment Seminar, Bangkok, Thailand, January 16, 1991.

"Fossil Fuels--Global Resources" a presentation by Anthony Reinsch at the Future of Fossil Fuel Symposium, Calgary, Alberta, January 26, 1991 (This was part of the 25th anniversary program at the University of Calgary.)

1990

November Results of CERI Study No. 35 Markets for British Columbia Natural Gas presented by Len Coad to a NARG User Group Meeting in California, to the British Columbia Ministry of Energy Mines and Petroleum Resources in Victoria and to a CanWest Gas Supply Inc./Westcoast Energy Inc. meeting in Vancouver.

Gerry Angevine spoke to the Nova Scotia Department of Mines Roundtable on Energy Policy in Halifax, Nova Scotia, November 5, 1990 on "Developments in Energy Policy and Regulation".

"The Status of Canada's Alternative Transportation Fuels". Presented by Michelle Heath to Petro-Canada's 1990 Environmental Conference, November 21-22, 1990.

October "Electricity Trade-Issues and Prospects" and "Energy Supply-Demand Balances: Crude Oil", two presentations by Anthony Reinsch to the Twelfth North American Conference of the International Association for Energy Economists, Ottawa, Ontario, October 1-3, 1990.

"New Coal Technologies, Environmental Initiatives and Electric Power Development". Presented by Morgan MacRae to the

Twelfth North American Conference of the International Association for Energy Economists, Ottawa, October 1-3, 1990.

September "World Oil Demands in the Mid 90s" by Anthony Reinsch at the Ninth CERI International Oil and Gas Markets Conference in Calgary, September 24, 1990.

June "World Oil Market Projections: Gauging the Uncertainties" by Anthony Reinsch at the Newfoundland Offshore Industries' Association Conference, St. John's, Newfoundland, June 5, 1990.

"Electricity Supply-Demand: Capacity Requirements in the 1990s" by Morgan MacRae at the CERI conference on Energy and Electricity: Electric Power Planning in the 1990s, Montreal, June 4, 1990.

May "Canada's Leading Alternative Fuels". Presented by Michelle Heath to the Conference on Oxygenated Fuels in Europe. London, England, May 22-23, 1990.

"Planning Uncertainties for the 1990s: World Oil Prices", seminar presentation by Anthony Reinsch, Calgary, May 17, 1990.

Len Coad spoke to a luncheon meeting of the Canadian Petroleum Tax Society on "Natural Gas in the 1990s" in Calgary.

April "Finding and Development Costs: Merits and Pitfalls". By Michele McLachlan to the Economics Society of Calgary Seminar, Calgary, April 25, 1990.

CERI Study No. 34, World Oil Market Projections: 1990-2005, seminar presentation by Anthony Reinsch, Calgary, April 19, 1990.

"Natural Gas: Fuel of the 1990s". Presented by Len Coad at the conference Gas Marketing: Current Issues for Producers in Calgary, April 9, 1990.